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Financial interventions and movement restrictions for managing the movement of health workers between public and private organizations in low- and middle-income countries (Review)

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[Intervention Review]

Financial interventions and movement restrictions for managing the movement of health workers between public and private organizations in low- and middle-income countries

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ABSTRACT

Background

Health workers move between public and private organizations in both urban and rural areas during the course of their career. Depending on the proportion of the population served by public or private organizations in a particular setting, this movement may result in imbalances in the number of healthcare providers available relative to the population receiving care from that sector. However, both public and private organizations are needed as each sector has unique contributions to make to the effective delivery of health services.

Objectives

To assess the effects of financial incentives and movement restriction interventions to manage the movement of health workers between public and private organizations in low- and middle-income countries.

Search methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (10 November 2012); EMBASE (7 June 2011); LILACS (9 June 2011); MEDLINE (10 November 2012); CINAHL (13 August 2012); and the British Nursing Index (13 August 2012).

Selection criteria

Randomized controlled trials and non-randomized controlled trials; controlled before-and-after studies if pre- and post-intervention periods for study and control groups were the same and there were at least two units included in both the intervention and control groups; uncontrolled and controlled interrupted time series studies if the point in time when the intervention occurred was clearly defined and there were at least three or more data points before and after the intervention. Interventions included payment of special allowances, increasing salaries, bonding health workers, offering bursary schemes, scholarships or lucrative terminal benefits, and hiring people on contract basis.

Data collection and analysis

Two review authors independently applied the criteria for inclusion and exclusion of studies to the titles and abstracts of all articles obtained from the search. The same two review authors independently screened the full reports of the selected citations. At each stage, we compared the results and resolved discrepancies through discussion with a third review author.

Main results

We found no studies that were eligible for inclusion in this review.

Authors' conclusions

We identified no rigorous studies on the effects of interventions to manage the movement of health workers between public and private organizations in low- and middle-income countries. Health worker availability is a key obstacle in delivery of health services. Interventions to make the health sector more responsive to the expectations of populations by having more health workers in the sector that serves most people would contribute to the more efficient use of the health workforce. More research is needed to assess the effect of increase in salaries, offering scholarships or bonding on movement of health workers in one sector compared with another.

PLAIN LANGUAGE SUMMARY

The effect of interventions to manage the movement of health workers between the public and the private health sector

Researchers in the Cochrane Collaboration conducted a review to evaluate the effect of approaches to encourage health workers to work in particular healthcare facilities. After searching for all relevant studies, they were unable to find any studies that met their requirements for inclusion in this review.

Background

Many countries have a severe lack of health workers. In addition, the health workers that are available are often not distributed in the best possible way. Most health workers work in urban areas, leaving rural areas underserved. Problems also occur in urban areas as health workers here often prefer to work in the private healthcare sector, which is often too expensive for many people. In rural areas, governments may not have built health facilities and the only available health care in these areas may, therefore, be private. However, private facilities in rural areas are not only expensive but may also struggle to attract qualified health workers.

To address these problems, governments need to find ways of ensuring that more health workers work in the areas and facilities where most people seek care. This might, for instance, involve encouraging health workers to work in public healthcare facilities in towns and cities or to work in public or private facilities in rural areas. One approach governments could take is to give extra incentives to health workers serving in particular facilities. These incentives could include higher salaries, special allowances, or higher retirement packages. Another approach is to give health workers bursaries or scholarships during training on the condition that they work in particular facilities for a fixed period of time after they have finished their training.

Results

Although these types of approaches are not uncommon, the review could not find any relevant studies that gave a reliable assessment of their impact. There is still a lot of work to be done to understand how governments can ensure that health workers serve in those health facilities that care for the majority of the population.

BACKGROUND

Health workers migrate between the public and the private sector due to many factors including seeking better pay, job security, better working conditions, and career opportunities (Schrecker 2004; McCoy 2008; Nguyen 2008). The public sector is a government-funded healthcare delivery system, while the private sector can be either non-profit making, such as non-governmental organizations (NGOs), or profit-making privately owned clinics and hospitals. The private sector has been expanding in many low- and middle-income countries and is now responsible for a large proportion of health care in many settings. However, governments in many low- and middle-income countries lack the capacity to enforce regulatory control of the private sector (Brugha 1998). The private sector also lacks the capacity to address public health challenges and is largely inaccessible to the lowest socioeconomic groups (Palmer 2003).

Several factors have been reported to affect the movement of health workers between the public and private sectors in low- and middle-income countries. In Namibia, for example, the presence of fringe benefits and conditions of service has been shown to attract and retain workers in the public sector while high salaries and non-financial incentives, such as recognition and communication, tend to attract and retain workers in the private sector (Lipinge 2006). In South Africa, high workload and low motivation in the public sector pushes health workers from the public to the private sector (Pillay 2009). In Mozambique, the many job opportunities created in NGO programmes and settings, and the reduced workload, closer supervision, and better equipment offered by these organizations have been shown to attract workers to the private sector (Pfeiffer 2003; Pfeiffer 2008). In addition, public health reforms that reduce the workforce tend to push workers away from the public sector in low-income countries (Lethbridge 2004). It is critical, therefore, that financial and non-financial interventions be evaluated for their effect on movement of health workers between the public and private sectors.

Description of the condition

The movement of health workers from the public to the private sector results, first, in large discrepancies in the populations served by these sectors, with a larger proportion of health workers serving a smaller proportion of the population who can access the private sector (Sarkin 2000). In South Africa in 1998, for instance, 52.7% of all general practitioners and 76% of all specialists worked in the private health sector. By 1999, reports suggested that the proportion of general practitioners working in the private sector had increased to 73% yet the private sector catered for less than 20% of the population (Goudge 2001). Second, the migration of health workers from the public to the private sector weakens a country's health system, especially the fragile health systems of low-income countries. In addition to the public sector being depleted of human resources, there is an increased management burden of coordinating various NGOs and other providers delivering services in a fragmented system (Pfeiffer 2008). Third, NGOs offer time-limited projects that use incentives to attract workforce from the public sector. This creates a health workforce that lacks organizational commitment as they move from organization to organization in pursuit of better salaries but with no job security. This loss of organizational commitment may result in a money-driven ethos among healthcare providers, with less regard for public good or organizational and professional commitment.

Several interventions have tried to reduce the migration of health workers from the public to the private sector or to replace workers who have left the public sector. One approach to replacing health workers who have left the public sector has been to increase the number of health workers trained. This, however, may not be effective if there is an increasing outwards migration from the public to the private sector (Walt 2002). Task shifting has been done to address loss of health workers. There have been attempts to recruit more workers into the public sector from among those working in the private sector. However, recruiting health workers into dysfunctional health systems that are not capable of attracting and retaining staff will not solve shortages (Kingma 2007). Some governments have also restricted health workers from leaving the public sector. It has been noted, though, that efforts to restrict migration need to address the views of both the public and private sectors or else tensions are inevitable (Walt 2002). For example, the private sector may see such restrictions as unfair competition. Government restrictions, it can also be argued, interfere with personal autonomy and health workers' rights to economic prosperity (Muula 2005).

Retention of staff in rural areas has been addressed through various means, for instance through binding newly qualified health workers to work in the public sector for a number of years and by recruiting foreign doctors to work in hard-to-reach areas (Grobler 2009). The retention of nurses in the public sector has also been enhanced through supportive organizational policies and by improving educational opportunities (Hayes 2010). Financial incentives have also been used to attract and retain workers in underserved areas (Willis-Shattuck 2008; Barnighausen 2009).

Both the public and the private sector have a role to play in low- and middle-income countries, especially where systems to deliver health services are weak but there is an urgent need to implement high-priority interventions. There are numerous examples of involving the private sector in the delivery of high-priority interventions. For example, using private providers increased access to treatment for febrile children in Kenya (Amin 2003; Goodman 2006). In Botswana, the roll-out of antiretroviral treatment involved deliberate inclusion of the private sector to implement the intervention and this reduced the workload of the public sector (Dreesch 2007). The private sector may also introduce expertise in marketing and distribution systems in health delivery systems; an area that is weak in the public sector (Widdus 2001). However, private sector expertise should not be utilized at the expense of weakening the public sector. In attempts to use private sector expertise, the private sector may be given more tasks and may expand by recruiting more workers to accept the increased responsibility. As the private sector recruits from the available workforce, it depletes public sector human resources. This is because the private sector recruits mostly from people who are already employed in public or other private organizations (van Rensburg 2008). Similarly, when the public sector recruits from the available workforce, it depletes the private sector, as happened in Uganda (Orach 2008). Such instances strengthen the public sector at the expense of weakening the private sector.

In summary, the current shortage of human resources, particularly in low- and middle-income countries, and the urgent need to deliver services and build sustainable health systems (World Health

Organization 2006), make interventions to manage the movement of health workers between the public and the private sector important. Such interventions may have consequences for short-, medium-, and long-term healthcare provision in low- and middle-income countries.

Description of the intervention

We considered financial incentives and movement restriction interventions that affect the movement of health workers between public and private health organizations. These included, among others:

1. Payment of special allowances to health workers working in the public or private sector.
2. Increasing salaries for public or private sector workers.
3. Bonding health workers for a number of years after training.
4. Bursary schemes where the recipients are required to work in the public or private sector.
5. Giving scholarships for specialization to health workers in public or private sector.
6. Giving lucrative terminal benefits to health workers who serve in the public or private sector for a mandatory number of years.
7. Hiring personnel on a contract basis. The high salaries for contract work would be comparable to the salaries paid in the other sector, which may be public or private.

The comparison groups were those health workers in the same sector who had not received a particular intervention.

How the intervention might work

These interventions work in two ways. The first is through making the particular sector that provides such financial incentives more lucrative, such as by payment of special allowances, increasing salaries, giving scholarships, giving lucrative terminal benefits, and hiring people on contract and hence giving them higher salaries. The second way is through restricting the outflow of health workers by bonding health workers for a mandatory time before they are available to move to other places of work.

Why it is important to do this review

The movement of health workers from the public to the private sector, or from the private to the public sector, affects the equity, accessibility, and sustainability of health services. The migration of health workers from the public sector to the private sector may lead to shortages of health workers in public health facilities. Health inequities are also likely to be widened where the public sector that serves the majority of people is understaffed, while the private sector has adequate health workers but caters for few people. Equity may also be worsened where the private sector is the predominant supplier in rural areas and health workers migrate from it to the public sector, which may not have many facilities in these areas. The larger part of the population (this time in the rural areas) is then served by fewer health workers. The migration of health workers between the public and the private sector also raises issues of sustainability. For instance, following the rolling out of human immunodeficiency virus (HIV) services in countries with weak health systems, the private sector expanded greatly to provide HIV/acquired immunodeficiency syndrome (AIDS) care, often with the support of international donors who aimed to reach a high number of people with HIV. Though this led to a large increase in the number of people accessing care in the short term, it also led to an exodus of public sector health workers to the private sector, further weakening already weak health systems. Ultimately, private-led service provision with a weakened public healthcare system is not sustainable. It is, therefore, important to regulate the movement of health workers to avoid creating an imbalance that would be detrimental to service delivery in the long term.

OBJECTIVES

To assess the effects of financial incentives and movement restriction interventions to manage the movement of health workers between public and private organizations in low- and middle-income countries.

METHODS

Criteria for considering studies for this review

Types of studies

We considered for inclusion:

- randomized controlled trials and non-randomized controlled trials;
- controlled before-and-after studies if the pre- and post-intervention periods were the same for the intervention and control groups and there were at least two units included in both the intervention and control groups;
- controlled interrupted time series and interrupted time series studies without controls;
- interrupted time series analyses if the point in time when the intervention occurred was clearly defined and there were at least three data points both before and after the intervention.

Types of participants

All health professionals employed in public and private sector in low- and middle-income countries (as defined by the World Bank), including physicians, nurses, midwives, nursing assistants, pharmacists, physiotherapists, occupational therapists, dentists, laboratory technicians, radiologists, and support staff such as managers, accountants and cleaners. We excluded community or village health workers who were not clearly categorized as formally employed health workers. However, if the community/lay health workers were employed by the state and were part of the civil service providing health services or if they were employed by the private providers and were clearly categorized as a formally employed worker, we considered them eligible for inclusion in the review.

Types of interventions

1. Financial interventions such as payment of special allowances; increasing salaries; and offering bursary schemes, scholarships, or lucrative terminal benefits to health workers who had served a continuous period in the public or private sector.
2. Establishment of a minimum number of years that a graduate needed to serve in public or private sector organizations based in rural areas before the health worker was allowed to accept employment elsewhere, for example through bonding.
3. Hiring health workers on a contract basis so that the salaries paid could match the high salaries that are paid in other

organizations. This helps to reduce the migration of health workers who may be attracted by high salaries in another sector.

Types of outcome measures

Primary outcomes

1. Change in the numbers or proportion of health workers entering or leaving the public or private sectors.
2. Duration of stay in a particular sector.

Secondary outcomes

1. Distribution of health workers between the public and private sectors.
2. Work satisfaction among health workers in the public and the private sectors.

Search methods for identification of studies

We searched for related systematic reviews using the Database of Abstracts of Reviews of Effectiveness (DARE). We searched for studies using the following bibliographic databases, sources, and approaches.

Electronic searches

We searched the following databases for primary studies:

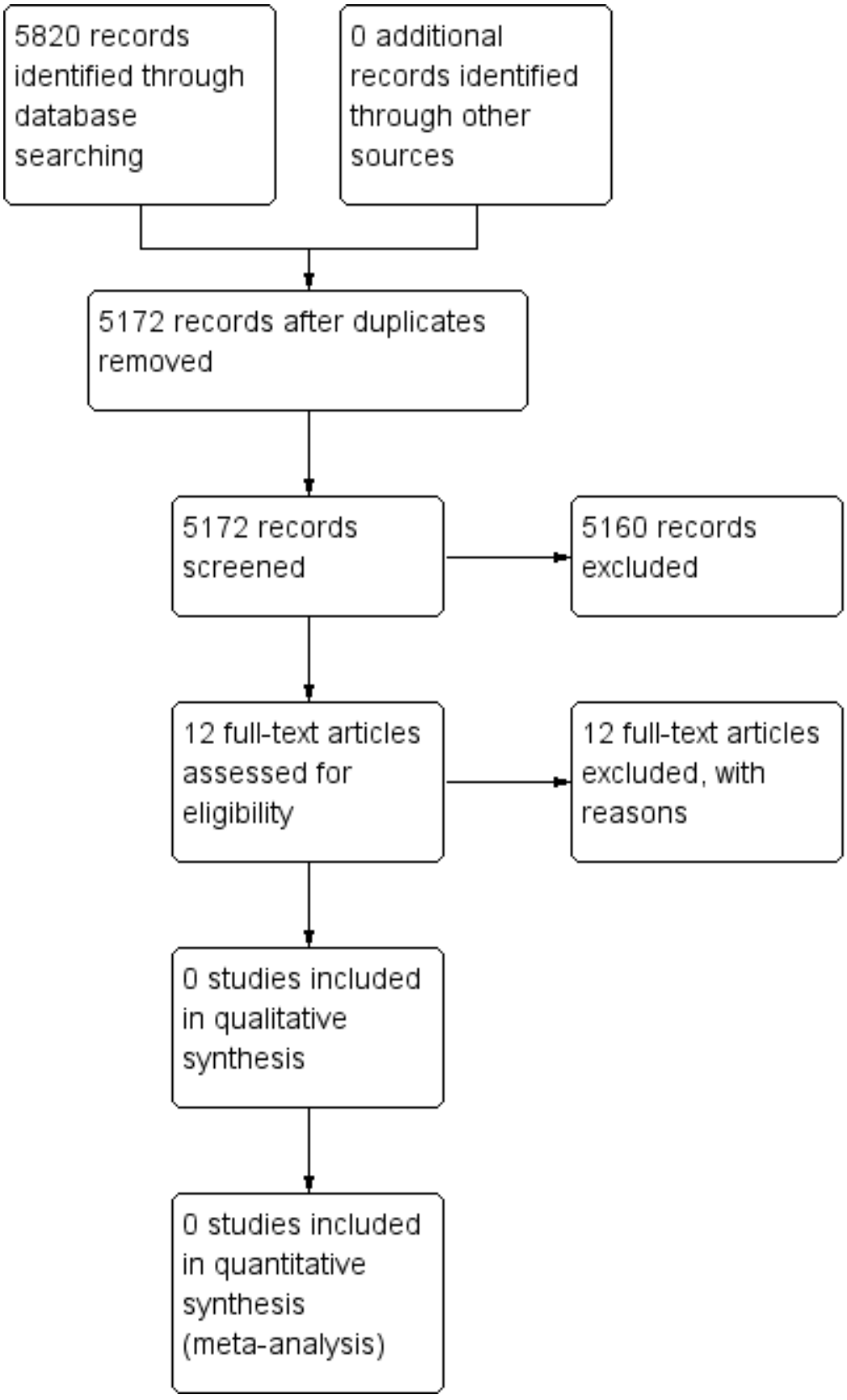
1. The Cochrane Central Register of Controlled Trials (CENTRAL) (www.thecochranelibrary.com), including the Cochrane Effective Practice and Organisation of Care (EPOC) Specialised Register (10 November 2012);
2. MEDLINE Ovid (1947 to 10 November 2012);
3. EMBASE Ovid (1980 to 7 June 2011);
4. LILACS, VHL (9 June 2011);
5. British Nursing Index Ovid (1985 to 13 August 2012);
6. CINAHL (13 August 2012).

We performed a pilot search in MEDLINE to identify the MeSH terms to use and this enabled us to identify relevant keywords and index terms. Full search strategies are shown in Appendix 1; Appendix 2; Appendix 3; Appendix 4; and Appendix 5.

Data collection and analysis

Our electronic searches produced 5172 records. We entered search results into Endnote X3. Two review authors (ER and AAK) independently screened the titles and abstracts of all articles obtained from the search. We obtained full-text copies of all the reports deemed eligible by either of the review authors for closer inspection. No studies met the inclusion criteria set out in the protocol of this review. The study flow chart is shown in Figure 1.

Figure 1. Study flow diagram.



We will apply the methods set out in Table 1 to any studies that meet the stipulated review inclusion criteria in the future.

RESULTS

Description of studies

Results of the search

We found no studies eligible for inclusion in this review.

Excluded studies

We obtained the full text of 12 potentially relevant studies, which we excluded because of inappropriate study design (Schrecker 2004; Chikanda 2005; Price 2005; Muula 2006; McCoy 2008; Mrayyan 2008; Hwang 2008; Hayajneh 2009; Abualrub 2009; Hwang 2009; Mrayyan 2009a; Barnett 2010). Nine of the studies were surveys (Chikanda 2005; Price 2005; McCoy 2008; Mrayyan 2008; Hwang 2008; Hayajneh 2009; Abualrub 2009; Hwang 2009; Mrayyan 2009a), one was a review of government reports (Barnett 2010), one was a study of speeches in the national assembly (Muula 2006), and one was a policy analysis paper (Schrecker 2004). The full list of papers and the reasons for exclusion are indicated in the Characteristics of excluded studies table.

Risk of bias in included studies

We found no studies eligible for inclusion in this review.

Effects of interventions

After close inspection of all the abstracts and articles retrieved, we found no studies that met the inclusion criteria of this systematic review.

DISCUSSION

Summary of main results

The main finding of this review is that there are currently no rigorous studies on the effectiveness of financial incentives and movement restriction interventions for managing the movement of health workers between public and private organizations in low- and middle-income countries. In addition, the review did not identify descriptions of an intervention whose aim was to affect the movement of health workers between the public and private sector. Some authors have postulated that the movement of health workers between the public and private sectors is part of a global 'conveyer belt' on which health workers move from the public sector in rural low-income countries, through the urban public and private sectors in low- and middle-income countries to the private sector in high-income countries (Schrecker 2004; Chikanda 2005). From this perspective, it would seem that the movement of health workers between the public and the private sector is but part of the bigger migration of health workers from the rural areas of low-income countries to the urban areas of high-income countries.

That notwithstanding, the movement of health workers between the public and private sectors results in imbalances in accessibility to care for the population, given that substantial numbers of people may access public facilities more than private facilities, or the other way round, even where the two exist side by side. Interventions that aim to improve the distribution of health workers may have an impact on access to health care for the population, especially for poorer people who may be unable to pay for care from the private sector. Some of the strategies that have been used to increase the number of health professionals in underserved areas may be helpful here. These include: financial incentives, such as bursaries and scholarships (Pathman 2004) and financial compensation (McCoy 2008); regulatory interventions, such as mandatory practice in the public sector before full registration; recruitment of healthcare providers from other countries to work in the public sector in rural areas or in the private sector, particularly in NGOs (Huddart 2003); and professional support and expectations of career progress (Mrayyan 2005). Some strategies that may be considered to manage the movement of health workers between the public and private sectors are outlined in Table 2.

Potential biases in the review process

We did not search the grey literature, which could be a potential risk for publication bias.

AUTHORS' CONCLUSIONS

Implications for practice

We found no studies that investigated financial incentives or movement restrictions for managing the movement of health workers between public and private organizations in low- and middle-income countries. Health worker availability remains one of the key barriers to strengthening health systems in low- and middle-income countries. If health systems are to achieve their goals of improving health and responding to the expectations of populations, governments need to examine how health workers are distributed between the public and private sectors. There may not be one formula for distributing health workers between public and private organizations that is suitable for all contexts. Where there is an imbalance between the health workers available in the public or private sectors and the proportion of the population served by that sector, interventions may be needed to redistribute health workers to better reflect workload. Interventions that aim to create a fair distribution of health workers between public and private organizations also need to take into account variations across settings, for example between rural and urban areas, in the proportion of the population served by these sectors.

Implications for research

No rigorous studies have been undertaken of the effects of interventions to manage the movement of health workers between the public and private sectors. Hypothetically, financial interventions, such as the payment of special allowances or lucrative terminal benefits offered in one sector, may pull health workers from another sector and at the same time retain health workers in the sector. Regulatory strategies such as bonding health workers in the public or private sector may hinder their movement to another sector. Opportunities for professional growth such as promotion and options for further education may also play a role in retaining some health workers in a particular sector. Some of these interventions have been used to draw health workers to rural or underserved areas and it is possible that they may have similar effects in drawing health workers to, or retaining them in, the public or private sectors. These potential interventions are discussed in more detail in Table 3; Table 4; and Table 5.

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CHARACTERISTICS OF STUDIES

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Abualrub 2009	Study design: a comparative descriptive survey using convenient samples of nurses from public and private hospitals
Barnett 2010	Study design: a review of government reports and policy documents on health workforce
Chikanda 2005	Study design: a survey with questionnaires filled by heads of health institutions and individual nursing professionals
Hayajneh 2009	Study design: a cross-sectional survey using interviews to investigate the turnover rate of nurses in hospitals
Hwang 2008	Study design: a cross-sectional survey using a self administered questionnaire conducted among hospital staff
Hwang 2009	Study design: a cross-sectional survey conducted among employees in public hospitals
McCoy 2008	Study design: a survey of historical trends in the pay of civil servants' salaries and income. Complete data were scanty
Mrayyan 2008	Study design: a cross-sectional survey among nurses of public, university teaching, and private hospitals
Mrayyan 2009a	Study design: a cross-sectional comparative design with interviews with nurses in public, university teaching, and private hospitals
Muula 2006	Study design: a qualitative study of speeches in the national assembly
Price 2005	Study design: a cross-sectional analysis of the medical register plus telephone interviews with doctors
Schrecker 2004	Study design: a policy analysis paper on how the international community might address the negative impact of the brain drain

ADDITIONAL TABLES

Table 1. Review methods

Study selection	Two review authors (ER and AAK) will screen the titles and abstracts of all articles obtained from the search. They will retrieve full copies of all articles selected as eligible by either of the review authors. The two review authors will then independently determine if studies meet the inclusion criteria. We will list studies that initially appear to meet the inclusion criteria but are later excluded based on review of the full text in the 'Characteristics of excluded studies' table, which will also give reasons for their exclusion. We will resolve disagreements between the two review authors through discussion with a third review author (SNK, FS, or GWP).
Assessment of methodological quality	We will use the Effective Practice and Organisation of Care (EPOC) risk of bias checklists for randomized controlled trials (RCTs), non-randomized controlled trials, and controlled before-and-after (CBA) studies to determine the quality of all eligible studies. Another risk of bias check-

Table 1. Review methods *(Continued)*

	list will be used for interrupted time series (ITS). These risk of bias checklists are available at: epoc.cochrane.org/epoc-resources-review-authors.
Data extraction	One review author (ER) will extract data from the included studies. This process will be independently cross-checked and confirmed by a second review author (AAK). We will develop a data extraction form based on an adaptation of that used by EPOC. Information will be extracted on study design, type of intervention, duration of intervention, participants (this will include the numbers in each group, for instance number of doctors in an organization), context or setting (which will include the country or region within the country), numbers or proportion of health workers entering or leaving the organizations. Other outcomes assessed will include promotion of only those in the public sector to be consultants and those in private sector not having a clear career path and work satisfaction in among health workers in the public and the private sector.
Data analysis	We will measure the effects of the interventions based on change in absolute numbers and relative change (percentage change) in the numbers of health workers. We will use odds ratios for dichotomous outcomes and mean differences for continuous outcomes. We will conduct the analysis at the same level as the allocation, using a summary measurement from each cluster. In those studies where the clustering effect has not been accounted for, we would do a re-analysis of the cluster randomized trials by getting a direct estimate of the required effect measure from an analysis that properly accounts for the cluster design. For those cluster randomized trials that do not report appropriate analysis, we will perform the approximate correct analyses if the following information can be extracted: 1. the number of clusters (or groups) randomized to each intervention group; or the mean size of each cluster; 2. the outcome data ignoring the cluster design for the total number of individuals (e.g. number or proportion of individuals with events, or means and standard deviations); and 3. an estimate of the intracluster (or intraclass) correlation coefficient (ICC). The size of each trial will be reduced to its effective sample size. The effective sample size of a single intervention group in a cluster-randomized trial will be considered as its original sample size divided by the design effect. A common design effect will be assumed across intervention groups. For dichotomous data, both the number of participants and the number experiencing the event will be divided by the same design effect. For continuous data, only the sample size will be reduced; means and standard deviations will remain unchanged. For those studies with multiple intervention groups, all relevant experimental intervention groups of the study will be combined into a single group, and all relevant control intervention groups will also be combined into a single control group. We will contact authors of included studies for missing data. Data obtained from authors of included studies will be excluded in sensitivity analyses. These data will be assessed to determine if it changes the results of the trial or is inconsistent with the findings. If there are missing data but the study authors are not able to provide this, we will analyse only available data. We will use intention-to-treat analysis. When the observed intervention effects are different from each other than one would expect due to chance alone, this will be taken to indicate that the studies have statistical heterogeneity. Heterogeneity will be taken as present when the difference between intervention effects is of P value of 0.10 or less. We will prepare a funnel plot and assess it for signs of asymmetry. We will not use funnel plots unless 10 studies or more are included. We will not do tests for funnel asymmetry when all the studies are of similar sizes. Using a visual inspection of the plot, when there is evidence of small-study effects, we will consider publication bias as one of the possible explanations. Other reasons for asymmetry that the data will be assessed for are: rank correlation between standardized intervention effect and its standard error; and the linear regression of intervention effect estimate against its standard error weighted by the inverse of the variance of the intervention effect estimate. For each study meeting our inclusion criteria, we will report the main results in natural units and calculate the change data if it is reported. The results for comparisons will be presented using a

Table 1. Review methods *(Continued)*

	standard method of presentation where possible. We will prepare tables and box plots comparing effect sizes of studies grouped according to potential effect modifiers. The type of intervention is the most likely effect modifier. Effects will also be based on the intensity of monitoring and penalties imposed as a result of violating the interventions. Other effect modifiers will include: type of health professional, and duration and level of intervention. If meta-analysis is possible, we will use the random-effects model because of a likelihood of heterogeneity in interventions and outcomes. In case meta-analysis is not possible, each study will be reported individually. We will prepare tables and box plots comparing effect sizes of studies grouped according to potential effect modifiers. These will include: 1. type of intervention; 2. duration of intervention; 3. outcomes of intervention. We expect to find substantial variation in the study results due to differences in types of interventions and duration of the intervention. We will only consider performing a meta-analysis when a group of trials is similar in terms of participants, interventions, and outcomes. We will use a random-effects model for meta-analysis to incorporate unexplained heterogeneity. We will perform the following sensitivity analyses: 1. all studies where data have been obtained from the authors will be excluded; 2. cluster randomized trials will be excluded; 3. the ICC that will be used for adjusting results from cluster randomized trials will be varied.

Table 2. Suggested strategies to manage the movement of health workers

Strategy	Intervention	Hypothesis	Comments
1. Financial incentives	Bursaries/scholarships	Providing bursaries to those in the private or public sector, and enforcing a mandatory service period after graduation to serve in that sector, may increase retention or attract more people to enter that sector, or both.	This intervention will depend on availability of funds, the ability of the sector to enforce the bonding and also on how lucrative the scholarships are vis-à-vis self sponsorship by the health workers themselves (Wilson 2009).
	Financial compensation	Providing incentives such as the payment of special allowances, increasing salaries or lucrative terminal benefits may attract people from one sector to another.	This intervention will work especially in those areas where the salaries of the health workers are low (Henderson 2008).
2. Regulatory interventions	Mandatory practice after graduation	Having recent graduates serve for a mandatory period in the facilities that sponsored them for training may hinder movement between sectors, at least in the first years after qualification.	This intervention will depend on the capacity of the sector to retain the health workers posted in the health facility (Ross 2009).
3. Recruitment policies	Recruitment of international doctors	Some countries may hire health workers from other countries to work in the public sector in rural areas where indigenous health workers are not willing to offer services. Some international non-governmental organizations may also have a system in which their recruits are provided with a period of exposure to rural areas, and may post such recruits to their rural private facilities.	This intervention will be dependent on the ability to support the international health workers in the relevant sector. This includes financial support as recruiting international health workers may be expensive. This intervention may be more applicable in middle-income countries, who may recruit health workers from low-income countries (Wilson 2009).

Table 2. Suggested strategies to manage the movement of health workers *(Continued)*

4. Religious motivation	Faith-based organizations recruiting workers on religious grounds	Workers in faith-based organizations may be motivated to stay in these organizations because of their religious affiliation.	This intervention may be difficult to measure because it is difficult to ascertain the contribution of a health worker's religious commitment to their choice of workplace. However, on an institutional level, it may be possible to assess how certain organizations use religious affiliation in recruiting health workers (Serneels 2010).
5. Opportunities for career progress	Providing opportunities for career progress, such as training schools and promotion	Health workers may work in a certain sector because of the opportunities that this provides for career progression.	Some governments may promote only those workers based in the public sector to consultant or specialist level. In addition, the selection of leaders in ministries or training institutions may favour health workers in public service, which, in turn, may influence the retention of health workers in the public sector (Houston 2000).

Table 3. Proposed research to evaluate increasing salaries and allowances for health workers as an approach to managing their movement between public and private organizations

Research focus 2	Core element	Issues to consider	Example
Intervention	Increasing the salaries and allowances for health workers in one sector and not the other	Often increases in one sector trigger an increase or some other intervention in other sectors. To ascertain the effects of this intervention, it is important that organizations where an increase in salaries has taken place be compared with those where an increase has not taken place.	There is documentation from Uganda where migration of health workers from the private-not-for-profit sector to government coincided with the increase in salaries for the government health workers (Orach 2008).
Existing literature	High salaries have attracted workers to, and retained them in, the private sector in Namibia (Lipinge 2006)	An increase in salaries has been seen as a key issue influencing the movement of workers to or from an organization. However, the increase in salary is usually combined with other interventions and the effects of the former may therefore be difficult to separate.	-
Population	Health professionals	All members of a cadre (or even all relevant cadres) might need to receive the salary increase as increasing salaries for some health workers and not for others may not be acceptable.	-
Comparison	No increase of salaries Other interventions to manage the movement of health workers	Other incentives such as the provision of accommodation or scholarships might be instituted in the comparison sector. These would need to be taken into account when assessing the effects of an increase in salaries.	-

Table 3. Proposed research to evaluate increasing salaries and allowances for health workers as an approach to managing their movement between public and private organizations *(Continued)*

Outcome	Movement of health workers from one sector to another Change in the rate of movement of health workers from one sector to another	It may be difficult to obtain data on the movement of health workers from one sector to another	-
Study design for research	Controlled before-and-after studies Interrupted time series studies	These studies may be at higher risk of bias, compared with RCTs, as they may not be able to control adequately for unknown confounders.	-

Table 4. Proposed research to evaluate offering scholarships to health workers as an approach to managing their movement between public and private organizations

Research focus 1	Core element	Issues to consider	Example
Intervention	Offering scholarships to health workers working in either the public or the private sector	The intervention could include all health workers but could also focus on specific cadres such as pharmacists, doctors, nurses, or midwives depending on the cadre for which movement needs to be changed.	Scholarships could be given to cadres, such as pharmacists, that generally prefer working in private rather than public practice. Receipt of a scholarship would be linked to a period of compulsory service in the public sector before the cadre may enter private practice.
Existing literature	No literature was identified	-	-
Population	Health professionals	Each cadre should be considered separately because the distribution of cadres between the public and the private sectors differs across cadres, as does the optimal balance between public and private sectors	-
Comparison	No scholarships	-	-
Outcome	Movement of health workers from one sector to another Satisfaction with work	It may be difficult to obtain data on the movement of health workers from one sector to another. Satisfaction with work is one of the factors that may influence workers remaining or moving to other sectors but may not be the only ones	-
Study design for research	Controlled before-and-after studies	These studies may be at higher risk of bias, compared with RCTs, as they may not be able to control adequately for unknown confounders.	-

Table 4. Proposed research to evaluate offering scholarships to health workers as an approach to managing their movement between public and private organizations *(Continued)*

	Interrupted time series studies

Table 5. Proposed research to evaluate bonding health workers as an approach to managing their movement between public and private organizations

Research focus 3	Core element	Issues to consider	Example
Intervention	Bonding health workers for a period of time before they are allowed to move between public and private sector organizations	Health workers who are bonded may have different characteristics to those who are not bonded. For example, these health workers may have been sponsored, or awarded a scholarship, by the particular institution because of their work excellence or because they had particular skills that the institutions needed.	No documented examples were identified of interventions to manage the movement health workers from one sector to another by bonding health workers for a period of time to one sector.
Existing literature	No literature was identified	-	-
Population	Health professionals	-	-
Comparison	Professionals of the same cadre in the same organization (such as a national health service) who are not bonded	-	-
Outcome	Movement of bonded health workers from one sector to another compared with those who are not bonded	Bonding may be implemented alongside other incentives and this may make it difficult to assess the effects of bonding alone. For example, a health worker who is sponsored to received further training and is then bonded to an institution, may also receive a promotion as a consequence of his/her training. His/her retention in the organization may be due to both the bonding and the promotion.	-
Study design for research	Controlled before-and-after studies Interrupted time series studies	These studies may be at higher risk of bias, compared with RCTs, as they may not be able to control adequately for unknown confounders.	-

APPENDICES

Appendix 1. CENTRAL search strategy

#1	MeSH descriptor Emigration and Immigration, this term only	80
#2	MeSH descriptor Population Dynamics, this term only	40
#3	MeSH descriptor Residential Mobility, this term only	10
#4	MeSH descriptor Transients and Migrants, this term only	38
#5	MeSH descriptor Career Choice, this term only	42
#6	MeSH descriptor Employment, this term only	651
#7	MeSH descriptor Workplace, this term only	405
#8	MeSH descriptor Personnel Selection, this term only	42
#9	MeSH descriptor Personnel Staffing and Scheduling, this term only	152
#10	MeSH descriptor Personnel Turnover, this term only	22
#11	(transfer* or movement* or move or moving or migrat* or emigrat* or immigrat*):ti,ab,kw in Clinical Trials	17,876
#12	((workplace or work place or job? or career? or employment) NEAR/3 (transfer* or chang* or shift* or swop* or swap* or interchang* or switch* or shuffl*)):ti,ab,kw in Clinical Trials	31
#13	(brain NEXT drain):ti,ab,kw in Clinical Trials	0
#14	(human resource*):ti,ab,kw in Clinical Trials	425
#15	((health* or medical or hospital or primary care) NEAR/3 (manpower or man power or workforce or work force or staff*)):ti,ab,kw in Clinical Trials	1221
#16	((distribut* or retain* or retention or recruit* or remain*) NEAR/6 (manpower or man power or workforce or work force or employee? or staff* or worker? or laborer? or labourer? or personnel)):ti,ab in Clinical Trials	218
#17	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR (# AND 8) OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16)	23,193
#18	MeSH descriptor Private Sector, this term only	77
#19	MeSH descriptor Hospitals, Private explode all trees	65
#20	MeSH descriptor Private Practice, this term only	94
#21	private:ti,ab in Clinical Trials	1421
#22	(#18 OR #19 OR #20 OR #21)	1453
#23	MeSH descriptor Public Sector, this term only	86
#24	MeSH descriptor Hospitals, Public explode all trees	711

(Continued)

#25	MeSH descriptor State Medicine, this term only	546
#26	public:ti,ab in Clinical Trials	3625
#27	(#23 OR #24 OR #25 OR #26)	4082
#28	(#22 OR #27)	5362
#29	MeSH descriptor Developing Countries, this term only	741
#30	(Africa or Asia or Caribbean or West indies or South America or Latin America or Central America):ti,ab,kw in Clinical Trials	2245
#31	(Afghanistan or Albania or Algeria or Angola or Antigua or Barbuda or Argentina or Armenia or Armenian or Aruba or Azerbaijan or Bahrain or Bangladesh or Barbados or Benin or Byelarus or Byelorussian or Belarus or Belorussian or Belorussia or Belize or Bhutan or Bolivia or Bosnia or Herzegovina or Hercegovina or Botswana or Brazil or Bulgaria or "Burkina Faso" or "Burkina Fasso" or "Upper Volta" or Burundi or Urundi or Cambodia or "Khmer Republic" or Kampuchea or Cameroon or Cameroons or Cameron or Camerons or "Cape Verde" or "Central African Republic" or Chad or Chile or China or Colombia or Comoros or "Comoro Islands" or Comores or Mayotte or Congo or Zaire or "Costa Rica" or "Cote d'Ivoire" or "Ivory Coast" or Croatia or Cuba or Cyprus or Czechoslovakia or "Czech Republic" or Slovakia or "Slovak Republic"):ti,ab,kw in Clinical Trials	4850
#32	(Djibouti or "French Somaliland" or Dominica or "Dominican Republic" or "East Timor" or "East Timur" or "Timor Leste" or Ecuador or Egypt or "United Arab Republic" or "El Salvador" or Eritrea or Estonia or Ethiopia or Fiji or Gabon or "Gabonese Republic" or Gambia or Gaza or Georgia or Georgian or Ghana or "Gold Coast" or Greece or Grenada or Guatemala or Guinea or Guam or Guiana or Guyana or Haiti or Honduras or Hungary or India or Maldives or Indonesia or Iran or Iraq or "Isle of Man" or Jamaica or Jordan or Kazakhstan or Kazakh or Kenya or Kiribati or Korea or Kosovo or Kyrgyzstan or Kirghizia or "Kyrgyz Republic" or Kirghiz or Kirgizstan or "Lao PDR" or Laos or Latvia or Lebanon or Lesotho or Basutoland or Liberia or Libya or Lithuania):ti,ab,kw in Clinical Trials	6914
#33	(Macedonia or Madagascar or "Malagasy Republic" or Malaysia or Malaya or Malay or Sabah or Sarawak or Malawi or Nyasaland or Mali or Malta or "Marshall Islands" or Mauritania or Mauritius or "Agalega Islands" or Mexico or Micronesia or "Middle East" or Moldova or Moldovia or Moldovian or Mongolia or Montenegro or Morocco or Ifni or Mozambique or Myanmar or Myanma or Burma or Namibia or Nepal or "Netherlands Antilles" or "New Caledonia" or Nicaragua or Niger or Nigeria or "Northern Mariana Islands" or Oman or Muscat or Pakistan or Palau or Palestine or Panama or Paraguay or Peru or Philippines or Philipines or Phillipines or Phillippines or Poland or Portugal or "Puerto Rico"):ti,ab,kw in Clinical Trials	3537
#34	(Romania or Rumania or Roumania or Russia or Russian or Rwanda or Ruanda or "Saint Kitts" or "St Kitts" or Nevis or "Saint Lucia" or "St Lucia" or "Saint Vincent" or "St Vincent" or Grenadines or Samoa or "Samoan Islands" or "Navigator Island" or "Navigator Islands" or "Sao Tome" or "Saudi Arabia" or Senegal or Serbia or Montenegro or Seychelles or "Sierra Leone" or Slovenia or "Sri Lanka" or Ceylon or "Solomon Islands" or Somalia or Sudan or Suriname or Surinam or Swaziland or Syria or Tajikistan or Tadzhikistan or Tadjikistan or Tadzhik or Tanzania or Thailand or Togo or "Togolese Republic" or Tonga or Trinidad or Tobago or Tunisia or Turkey or Turkmenistan or Turkmen or Uganda or Ukraine or Uruguay or USSR or "Soviet Union" or "Union of Soviet Socialist Republics" or Uzbekistan or Uzbek or Vanuatu or "New Hebrides" or Venezuela or Vietnam or "Viet Nam" or "West Bank" or Yemen or Yugoslavia or Zambia or Zimbabwe or Rhodesia):ti,ab,kw in Clinical Trials	4247

(Continued)

#35	(developing or less* NEXT developed or "under developed" or underdeveloped or "middle income" or low* NEXT income or underserved or "under served" or deprived or poor*) NEXT (countr* or nation* or population* or world):ti,ab,kw in Clinical Trials	1561
#36	(developing or less* NEXT developed or "under developed" or underdeveloped or "middle income" or low* NEXT income) NEXT (economy or economies):ti,ab,kw in Clinical Trials	1
#37	low* NEXT (gdp or gnp or "gross domestic" or "gross national"):ti,ab,kw in Clinical Trials	19
#38	(low NEAR/3 middle NEAR/3 countr*):ti,ab,kw in Clinical Trials	2
#39	(lmic or lmics or "third world" or "lami country" or "lami countries"):ti,ab,kw in Clinical Trials	27
#40	("transitional country" or "transitional countries"):ti,ab,kw in Clinical Trials	0
#41	(#29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40)	20,465
#42	(#17 AND #28 AND #41)	50

Appendix 2. MEDLINE search strategy

1 "Emigration and Immigration"/

2 Population Dynamics/

3 Residential Mobility/

4 "Transients and Migrants"/

5 Career Choice/

6 Employment/

7 Workplace/

8 Personnel Selection/

9 "Personnel Staffing and Scheduling"/

10 Personnel Turnover/

11 (transfer* or movement* or move or moving or migrat* or emigrat* or immigrat*).ti,ab.

12 ((workplace or work place or job? or career? or employment) adj3 (transfer* or chang* or shift* or swop* or swap* or interchange*or switch* or shuffl*)).ti,ab.

13 brain drain.ti,ab.

14 human resources.ti,ab.

15 ((health* or medical or hospital or primary care) adj6 (manpower or man power or workforce or work force or staff*)).ti,ab.

16 ((distribut* or retain* or retention or recruit* or remain*) adj6 (manpower or man power or workforce or work force or employee? or staff* or worker? or laborer? or labourer? or personnel)).ti,ab.

17 or/1-16

18 Private Sector/

19 exp Hospitals, Private/

20 Private Practice/

21 private.ti,ab.

22 or/18-21

23 Public Sector/

24 exp Hospitals, Public/

25 State Medicine/

26 public.ti,ab.

27 or/23-26

28 22 or 27

29 Developing Countries.sh,kf.

30 (Africa or Asia or Caribbean or West Indies or South America or Latin America or Central America).hw,kf,ti,ab,cp.

31 (Afghanistan or Albania or Algeria or Angola or Antigua or Barbuda or Argentina or Armenia or Armenian or Aruba or Azerbaijan or Bahrain or Bangladesh or Barbados or Benin or Byelarus or Byelorussian or Belarus or Belorussian or Belorussia or Belize or Bhutan or Bolivia or Bosnia or Herzegovina or Hercegovina or Botswana or Brazil or Brasil or Bulgaria or Burkina Faso or Burkina Fasso or Upper Volta or Burundi or Urundi or Cambodia or Khmer Republic or Kampuchea or Cameroon or Cameroons or Cameron or Camerons or Cape Verde or Central African Republic or Chad or Chile or China or Colombia or Comoros or Comoro Islands or Comores or Mayotte or Congo or Zaire or Costa Rica or Cote d'Ivoire or Ivory Coast or Croatia or Cuba or Cyprus or Czechoslovakia or Czech Republic or Slovakia or Slovak Republic or Djibouti or French Somaliland or Dominica or Dominican Republic or East Timor or East Timur or Timor Leste or Ecuador or Egypt or United Arab Republic or El Salvador or Eritrea or Estonia or Ethiopia or Fiji or Gabon or Gabonese Republic or Gambia or Gaza or Georgia Republic or Georgian Republic or Ghana or Gold Coast or Greece or Grenada or Guatemala or Guinea or Guam or Guiana or Guyana or Haiti or Honduras or Hungary or India or Maldives or Indonesia or Iran or Iraq or Isle of Man or Jamaica or Jordan or Kazakhstan or Kazakh or Kenya or Kiribati or Korea or Kosovo or Kyrgyzstan or Kirghizia or Kyrgyz Republic or Kirghiz or Kirgizstan or Lao PDR or Laos or Latvia or Lebanon or Lesotho or Basutoland or Liberia or Libya or Lithuania or Macedonia or Madagascar or Malagasy Republic or Malaysia or Malaya or Malay or Sabah or Sarawak or Malawi or Nyasaland or Mali or Malta or Marshall Islands or Mauritania or Mauritius or Agalega Islands or Mexico or Micronesia or Middle East or Moldova or Moldovia or Moldovian or Mongolia or Montenegro or Morocco or Ifni or Mozambique or Myanmar or Myanma or Burma or Namibia or Nepal or Netherlands Antilles or New Caledonia or Nicaragua or Niger or Nigeria or Northern Mariana Islands or Oman or Muscat or Pakistan or Palau or Palestine or Panama or Paraguay or Peru or Philippines or Philipines or Phillipines or Phillippines or Poland or Portugal or Puerto Rico or Romania or Rumania or Roumania or Russia or Russian or Rwanda or Ruanda or Saint Kitts or St Kitts or Nevis or Saint Lucia or St Lucia or Saint Vincent or St Vincent or Grenadines or Samoa or Samoan Islands or Navigator Island or Navigator Islands or Sao Tome or Saudi Arabia or Senegal or Serbia or Montenegro or Seychelles or Sierra Leone or Slovenia or Sri Lanka or Ceylon or Solomon Islands or Somalia or Sudan or Suriname or Surinam or Swaziland or Syria or Tajikistan or Tadzhikistan or Tadjikistan or Tadzhik or Tanzania or Thailand or Togo or Togolese Republic or Tonga or Trinidad or Tobago or Tunisia or Turkey or Turkmenistan or Turkmen or Uganda or Ukraine or Uruguay or USSR or Soviet Union or Union of Soviet Socialist Republics or Uzbekistan or Uzbek or Vanuatu or New Hebrides or Venezuela or Vietnam or Viet Nam or West Bank or Yemen or Yugoslavia or Zambia or Zimbabwe or Rhodesia).hw,kf,ti,ab,cp.

32 ((developing or less* developed or under developed or underdeveloped or middle income or low* income or underserved or under served or deprived or poor*) adj (countr* or nation? or population? or world)).ti,ab.

33 ((developing or less* developed or under developed or underdeveloped or middle income or low* income) adj (economy or economies)).ti,ab.

34 (low* adj (gdp or gnp or gross domestic or gross national)).ti,ab.

35 (low adj3 middle adj3 countr*).ti,ab.

36 (lmic or lmics or third world or lami countr*).ti,ab.

37 transitional countr*.ti,ab.

38 or/29-37

39 randomized controlled trial.pt.

40 controlled clinical trial.pt.

41 multicenter study.pt.

42 random*.ti,ab.

43 trial.ti,ab.

44 ((multicenter or multicentre or multi center or multi centre) adj study).ti,ab.

45 intervention*.ti,ab.

46 control*.ti,ab.

47 evaluat*.ti,ab.

48 effect?.ti,ab.

49 impact?.ti,ab.

50 (time series or time points).ti,ab.

51 (quasi experiment* or quasiexperiment*).ti,ab.

52 or/39-51

53 Animals/

54 Humans/

55 53 not (53 and 54)

56 52 not 55

57 17 and 28 and 38 and 56

58 "comment on".cm.

59 (systematic review or literature review).ti.

60 (editorial or comment or meta-analysis or news or review).pt.

61 "cochrane database of systematic reviews".jn.

62 or/58-61

63 57 not 62

Appendix 3. EMBASE search strategy

1. migration/

2. population dynamics/

3. Residential Mobility/

4. career mobility/

5. Employment/

6. employment status/

7. parttime employment/

8. self employment/

9. temporary employment/

10. workplace/

11. personnel/

12. personnel shortage/

13. manpower/

14. manpower planning/

15. Personnel turnover/

16. (transfer* or movement* or move* or moving or migrat* or emigrat* or immigrat*).ti,ab.

17. ((workplace or work place or job? or career? or employment or vocation?) adj3 (transfer* or chang* or shift* or swop* or swap* or interchang* or switch* or shuffl*)).ti,ab.

18. brain drain.ti,ab.

19. human resources.ti,ab.

20. ((health* or medical or hospital? or primary care) adj6 (manpower or man power or workforce or work force or staff*)).ti,ab.

21. ((distribut* or retain* or retention or recruit* or remain*) adj6 (manpower or man power or workforce or work force or employee? or staff* or worker? or laborer? or labourer? or personnel)).ti,ab.

22. or/1-21

23. "organization and management"/

24. private hospital/

25. private practice/

26. private.ti,ab.

27. or/23-26

28. public hospital/

29. national health service/

30. public.ti,ab.

31. "organization and management"/

32. or/28-31

33. 27 or 32

34. Developing Country.sh.

35. (Africa or Asia or Caribbean or West Indies or South America or Latin America or Central America).hw,ti,ab,cp.

36. (Afghanistan or Albania or Algeria or Angola or Antigua or Barbuda or Argentina or Armenia or Armenian or Aruba or Azerbaijan or Bahrain or Bangladesh or Barbados or Benin or Byelarus or Byelorussian or Belarus or Belorussian or Belorussia or Belize or Bhutan or Bolivia or Bosnia or Herzegovina or Hercegovina or Botswana or Brazil or Brasil or Bulgaria or Burkina Faso or Burkina Fasso or Upper Volta or Burundi or Urundi or Cambodia or Khmer Republic or Kampuchea or Cameroon or Cameroons or Cameron or Camerons or Cape Verde or Central African Republic or Chad or Chile or China or Colombia or Comoros or Comoro Islands or Comores or Mayotte or Congo or Zaire or Costa Rica or Cote d'Ivoire or Ivory Coast or Croatia or Cuba or Cyprus or Czechoslovakia or Czech Republic or Slovakia or Slovak Republic or Djibouti or French Somaliland or Dominica or Dominican Republic or East Timor or East Timur or Timor Leste or Ecuador or Egypt or United Arab Republic or El Salvador or Eritrea or Estonia or Ethiopia or Fiji or Gabon or Gabonese Republic or Gambia or Gaza or Georgia Republic or Georgian Republic or Ghana or Gold Coast or Greece or Grenada or Guatemala or Guinea or Guam or Guiana or Guyana or Haiti or Honduras or Hungary or India or Maldives or Indonesia or Iran or Iraq or Isle of Man or Jamaica or Jordan or Kazakhstan or Kazakh or Kenya or Kiribati or Korea or Kosovo or Kyrgyzstan or Kirghizia or Kyrgyz Republic or Kirghiz or Kirgizstan or Lao PDR or Laos or Latvia or Lebanon or Lesotho or Basutoland or Liberia or Libya or Lithuania or Macedonia or Madagascar or Malagasy Republic or Malaysia or Malaya or Malay or Sabah or Sarawak or Malawi or Nyasaland or Mali or Malta or Marshall Islands or Mauritania or Mauritius or Agalega

Islands or Mexico or Micronesia or Middle East or Moldova or Moldovia or Moldovian or Mongolia or Montenegro or Morocco or Ifni or Mozambique or Myanmar or Myanma or Burma or Namibia or Nepal or Netherlands Antilles or New Caledonia or Nicaragua or Niger or Nigeria or Northern Mariana Islands or Oman or Muscat or Pakistan or Palau or Palestine or Panama or Paraguay or Peru or Philippines or Philipines or Phillipines or Phillippines or Poland or Portugal or Puerto Rico or Romania or Rumania or Roumania or Russia or Russian or Rwanda or Ruanda or Saint Kitts or St Kitts or Nevis or Saint Lucia or St Lucia or Saint Vincent or St Vincent or Grenadines or Samoa or Samoan Islands or Navigator Island or Navigator Islands or Sao Tome or Saudi Arabia or Senegal or Serbia or Montenegro or Seychelles or Sierra Leone or Slovenia or Sri Lanka or Ceylon or Solomon Islands or Somalia or Sudan or Suriname or Surinam or Swaziland or Syria or Tajikistan or Tadzhikistan or Tadjikistan or Tadzhik or Tanzania or Thailand or Togo or Togolese Republic or Tonga or Trinidad or Tobago or Tunisia or Turkey or Turkmenistan or Turkmen or Uganda or Ukraine or Uruguay or USSR or Soviet Union or Union of Soviet Socialist Republics or Uzbekistan or Uzbek or Vanuatu or New Hebrides or Venezuela or Vietnam or Viet Nam or West Bank or Yemen or Yugoslavia or Zambia or Zimbabwe or Rhodesia).hw,ti,ab,cp.

37. ((developing or less* developed or under developed or underdeveloped or middle income or low* income or underserved or under served or deprived or poor*) adj (countr* or nation? or population? or world)).ti,ab.

38. ((developing or less* developed or under developed or underdeveloped or middle income or low* income) adj (economy or economies)).ti,ab.

39. (low* adj (gdp or gnp or gross domestic or gross national)).ti,ab.

40. (low adj3 middle adj3 countr*).ti,ab.

41. (lmic or lmics or third world or lami countr*).ti,ab.

42. transitional countr*.ti,ab.

43. or/34-42

44. Randomized controlled trial/

45. Time Series Analysis/

46. (randomised or randomized).tw.

47. experiment$.tw.

48. (time adj series).tw.

49. (pre test or pretest or post test or posttest).tw.

50. impact.tw.

51. intervention?.tw.

52. chang$.tw.

53. evaluat$.tw.

54. effect?.tw.

55. compar$.tw.

56. or/44-55

57. nonhuman/

58. 56 not 57

59. 22 and 33 and 43 and 58

60. (systematic review or literature review).ti.

61. (editorial or comment or meta-analysis or news or review).pt.

62. "cochrane database of systematic reviews".jn.

63. or/60-62

64. 59 not 63

Appendix 4. LILACS search strategy

("emigration and immigration" or "population and dynamics" or "residential and mobility" or "transients and migrants" or "career and choice" or "employment" or "workplace" or "personnel and selection" or "personnel and staffing and scheduling" or "personnel and turnover") or (transfer$ or movement$ or move or moving or migrat$ or emigrat$ or immigrat$) or ((workplace or "work and place" or job$ or career$ or employment) AND (transfer$ or chang$ or shift$ or swop$ or swap$ or interchange$ or switch$ or shuffl$)) or ("brain and drain" or "human and resources") or ((health$ or medical or hospital or "primary and care") AND (manpower or "man and power" or workforce or "work and force" or staff$)) or ((distribut$ or retain$ or retention or recruit$ or remain$) AND (manpower or "man and power" or workforce or "work and force" or employee$ or staff$ or worker$ or laborer$ or labourer$ or personnel)) AND ("private and sector" or "hospitals, private" or "private and practice" or private)

Appendix 5. British Nursing Index search strategy

1. "Staff : Recruitment and Turnover"/

2. "Careers and Career Planning"/

3. "Employment and Unemployment"/

4. staff : welfare/

5. "Staff : Conditions of Service"/

6. "Staff : Job Satisfaction"/

7. (transfer* or movement* or move* or moving or migrat* or emigrat* or immigrat*).ti,ab.

8. ((workplace or work place or job? or career? or employment or vocation?) adj3 (transfer* or chang* or shift* or swop* or swap* or interchang* or switch* or shuffl*)).ti,ab.

9. brain drain.ti,ab.

10. human resources.ti,ab.

11. ((health* or medical or hospital? or primary care) adj6 (manpower or man power or workforce or work force or staff*)).ti,ab.

12. ((distribut* or retain* or retention or recruit* or remain*) adj6 (manpower or man power or workforce or work force or employee? or staff* or worker? or laborer? or labourer? or personnel)).ti,ab.

13. or/1-12

14. Private Health Care/

15. "General Practice and Hospitals"/

16. 14 or 15

17. developing countries.sh,ti,ab.

18. (Africa or Asia or Caribbean or "West Indies" or "South America" or "Latin America" or "Central America").ti,ab,sh.

19. (Afghanistan or Albania or Algeria or Angola or Antigua or Barbuda or Argentina or Armenia or Armenian or Aruba or Azerbaijan or Bahrain or Bangladesh or Barbados or Benin or Byelarus or Byelorussian or Belarus or Belorussian or Belorussia or Belize or Bhutan or Bolivia or Bosnia or Herzegovina or Hercegovina or Botswana or Brazil or Bulgaria or Burkina Faso or Burkina Fasso or Upper Volta or Burundi or Urundi or Cambodia or Khmer Republic or Kampuchea or Cameroon or Cameroons or Cameron or Camerons or Cape Verde or Central African Republic or Chad or Chile or China or Colombia or Comoros or Comoro Islands or Comores or Mayotte or Congo or Zaire or Costa Rica or Cote d'Ivoire or Ivory Coast or Croatia or Cuba or Cyprus or Czechoslovakia or Czech Republic or Slovakia or Slovak Republic or Djibouti or French Somaliland or Dominica or Dominican Republic or East Timor or East Timur or Timor Leste or Ecuador or Egypt or United Arab Republic or El Salvador or Eritrea or Estonia or Ethiopia or Fiji or Gabon or Gabonese Republic or Gambia or Gaza or Georgia Republic or Georgian Republic or Ghana or Gold Coast or Greece or Grenada or Guatemala or Guinea or Guam or Guiana or Guyana or Haiti or Honduras or Hungary or India or Maldives or Indonesia or Iran or Iraq or Isle of Man or Jamaica or Jordan or Kazakhstan or Kazakh or Kenya or Kiribati or Korea or Kosovo or Kyrgyzstan or Kirghizia or Kyrgyz Republic or Kirghiz or Kirgizstan or Lao PDR or Laos or Latvia or Lebanon or Lesotho or Basutoland or Liberia or Libya or Lithuania or Macedonia or Madagascar or Malagasy Republic or Malaysia or Malaya or Malay or Sabah or Sarawak or Malawi or Nyasaland or Mali or Malta or Marshall Islands or Mauritania or Mauritius or Agalega Islands or Mexico or Micronesia or Middle East or Moldova or Moldovia or Moldovian or Mongolia or Montenegro or Morocco or Ifni or

Mozambique or Myanmar or Myanma or Burma or Namibia or Nepal or Netherlands Antilles or New Caledonia or Nicaragua or Niger or Nigeria or Northern Mariana Islands or Oman or Muscat or Pakistan or Palau or Palestine or Panama or Paraguay or Peru or Philippines or Philipines or Phillipines or Phillippines or Poland or Portugal or Puerto Rico or Romania or Rumania or Roumania or Russia or Russian or Rwanda or Ruanda or Saint Kitts or St Kitts or Nevis or Saint Lucia or St Lucia or Saint Vincent or St Vincent or Grenadines or Samoa or Samoan Islands or Navigator Island or Navigator Islands or Sao Tome or Saudi Arabia or Senegal or Serbia or Montenegro or Seychelles or Sierra Leone or Slovenia or Sri Lanka or Ceylon or Solomon Islands or Somalia or Sudan or Suriname or Surinam or Swaziland or Syria or Tajikistan or Tadzhikistan or Tadjikistan or Tadzhik or Tanzania or Thailand or Togo or Togolese Republic or Tonga or Trinidad or Tobago or Tunisia or Turkey or Turkmenistan or Turkmen or Uganda or Ukraine or Uruguay or USSR or Soviet Union or Union of Soviet Socialist Republics or Uzbekistan or Uzbek or Vanuatu or New Hebrides or Venezuela or Vietnam or Viet Nam or West Bank or Yemen or Yugoslavia or Zambia or Zimbabwe or Rhodesia).ti,ab,sh.

20. ((developing or less* developed or "under developed" or underdeveloped or "middle income" or low* income or underserved or "under served" or deprived or poor*) adj (countr* or nation* or population* or world)).ti,ab.

21. ((developing or less* developed or "under developed" or underdeveloped or "middle income" or low* income) adj (economy or economies)).ti,ab.

22. (low* adj (gdp or gnp or "gross domestic" or "gross national")).ti,ab.

23. (low adj3 middle adj3 countr*).ti,ab.

24. (lmic or lmics or third world or lami countr*).ti,ab.

25. transitional countr*.ti,ab.

26. or/17-25

27. randomized controlled trial.ti,ab,sh,hw.

28. controlled clinical trial.ti,ab,sh,hw.

29. ((multicenter or multicentre or multi center or multi centre) adj study).ti,ab,sh,hw.

30. random*.ti,ab.

31. trial.ti,ab.

32. intervention*.ti,ab.

33. control*.ti,ab.

34. evaluat*.ti,ab.

35. effect*.ti,ab.

36. impact*.ti,ab.

37. (time series or time points).ti,ab.

38. (quasi experiment* or quasiexperiment*).ti,ab.

39. or/27-38

40. 13 and 16 and 26 and 39

41. 13 and 16 and 39

42. 13 and 26 and 39

43. or/40-42

CONTRIBUTIONS OF AUTHORS

Elizeus Rutebemberwa - lead author of the review.

Alison A Kinengyere - conducted part of the literature search, screened articles, and extracted the data.

Freddie Ssengooba - made substantial input on the review draft.

George W Pariyo - made substantial input on the review draft.

Suzanne N Kiwanuka - made substantial input on the review draft.

DECLARATIONS OF INTEREST

None known.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

None.

INDEX TERMS

Medical Subject Headings (MeSH)

*Developing Countries; *Employee Incentive Plans; *Private Sector; *Public Sector; Health Workforce [*economics]; Personnel Turnover [*economics]

MeSH check words

Humans